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In re Patent Application of

KUMAR

Serial No. **09/831,555**

Filed: **August 14, 2001**

For: **SCANNING OF ELECTROMAGNETIC BEAMS**

Atty. Ref.: **540-311**

Group: **2821**

Examiner: **M. Wimer**

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APPEAL BRIEF

On Appeal From Group Art Unit 2821

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I. REAL PARTY IN INTEREST

The real party in interest in the above-identified appeal is BAE SYSTEMS ELECTRONICS LIMITED by virtue of the Assignment recorded August 14, 2001 at Reel 12095, Frame 0010.

II. RELATED APPEALS AND INTERFERENCES

There are believed to be no related appeals or interferences with respect to the present application and appeal.

III. STATUS OF CLAIMS

Claims 9-12 stand allowed, with claims 1-6, 13-23, 25 and 27 rejected in the outstanding Final Rejection.

IV. STATUS OF AMENDMENTS

No amendments under Rule 116 were submitted and the rejection of the claims set out in the Final Rejection remains in force.

V. SUMMARY OF THE INVENTION

The present invention relates to the controlling of a radiation beam, and in particular, the controlling of the scanning of a radiation beam in an azimuthal direction.

In communications systems and particularly microwave communication systems it is desirable to be able to steer a microwave communications beam to

any position in the azimuthal direction. In the past, such scanning has been accomplished by moving mechanical components so as to focus an antenna in the various azimuthal directions.

It is also known to use an omnidirectional antenna, such as that disclosed in WO 97/29525 to Robertson et al, which provides a very small amount of microwave energy in all directions -- hence the name omnidirectional antenna. Unfortunately, this requires an inordinately large radiation power, since it is dispersed in all directions by the conical reflector. This also has the disadvantage with respect to military communications, in that an enemy can sense the direction of radiation of the communications radiation and target that location.

It is also known to use ferrite blocks with coils. This is illustrated in the patent to Tang et al (U.S. Patent 4,588,994), and as shown in Figure 6, variation in the magnetic field created serves to vary the delay of the radiation propagation speed through the ferrite core, resulting in an electronically steered phased array antenna. However, there is no beam applied to the ferrite block and instead uniform radiation would be applied resulting in the uniform variation in delay across the block. Of course, such an electronically steered antenna effectively has a scan range of much less than 180° and would in practical terms require at least three, and most probably four, sets of arrays in order to be able to electronically scan a communications beam around a 360° azimuth.

Appellant found that if a gradient in magnetization is provided across a ferrite body, a beam incident on the body will exit in a direction parallel to the original central axis of the body, but spatially displaced from the central axis. By varying the strength of the magnetic field provided, the azimuthal location in an ellipse around the central axis can be controlled. Thus, the exit point of the beam direction can be rotated around the central axis or incident point of the beam on the ferrite body. Thus, in a preferred embodiment, a simple conical reflector placed above the ferrite body permits the electronic scanning of a microwave communications beam in a 360° azimuthal direction without the requirement of mechanical rotating antennas.

The invention is characterized by a "**transmission means for transmitting the radiation beam from a radiation source**" and "a steering means" causing "the radiation beam to emerge from the transmission means **spatially offset relative to the central axis** in free space in a known direction."

VI. ISSUES

Whether claims 1-8, 15-19, 22 and 23 are anticipated by Tang (U.S. Patent 4,588,994).

Whether claims 13, 14, 20, 21, 25 and 27 are obvious over Tang in view of Robertson (WO 97/29525).

VII. GROUPING OF CLAIMS

The rejected claims stand or fall together and are distinguished over the prior art in the argument portion of this Appeal Brief.

VIII. ARGUMENT

1. Discussion of the References

Tang et al (U.S. Patent 4,588,994) teaches a ferrite aperture for an electronic scanning antenna in which a tapered magnetization is applied to the ferrite blocks. Electromagnetic energy is uniformly applied, i.e., not a beam, to and travels through the block. The radiation exits the radiating surface of the block and has been phase shifted with respect to the energy entering the block in a similar tapered fashion. The degree of phase shift can be varied by adjusting the slope of the tapered magnetization.

The uniform radiation emerging from the ferrite blocks in Tang is not displaced from the central axis and does not exit the block in a direction parallel to but spatially offset from the central axis.

Robertson et al (WO 97/29525) teaches an "omnidirectional antenna" which provides continuous radiation over substantially 360° in azimuth by illuminating a conical reflector. The beam from the waveguide is focused on the end of a conical reflector, with the effect that the radiation beam is dispersed in 360° in azimuth, thereby providing broadcast dispersion all around the antenna.

Robertson specifically teaches away from any electronic scanning in azimuth by suggesting instead that it is appropriate to broadcast in all 360° of azimuth simultaneously. Moreover, Robertson clearly teaches away from any spatial offset in the beam, because since its goal is to broadcast evenly in all directions, the beam is focused directly on the axis of the cone, and thus it clearly teaches away from any use of a steering means for causing the beam to be "spatially offset relative to the central axis."

2. Discussion of the Rejections

Claims 1-8, 15-19, 22 and 23 are alleged to be anticipated under 35 USC §102 in view of Tang. To the extent the Examiner's rejection is understood, the Examiner appears to believe that all structures recited in appellant's independent claim and the rejected claims dependent thereon are shown in the Tang reference. Specifically, the Examiner alleges that in Tang the radiation emerges "from the transmission means offset relative to the central axis in free space in a known direction."

Claims 13, 14, 20, 21, 25 and 27 stand rejected under 35 USC §103 as being unpatentable over Tang in view of Robertson. The Examiner presumably applies Tang in the manner applied previously in the anticipation rejection, and to the extent it is understood, relies upon Robertson as teaching a conical reflector. The Examiner contends it would have been obvious to employ such a reflector in

the system of Tang "to prevent scattering," although the Official Action is not clear as to what "scattering" might be.

3. The Errors in the Final Rejection

There are at least three significant errors in the Final Rejection and they are summarized as follows:

(a) No reference teaches a steering means causing a "spatial offset relative to the central axis;"

(b) Robertson's omnidirectional antenna teaches away from scanning and offset; and

(c) The Examiner has failed to provide any reason for combining elements taken from Tang and Robertson.

(a) No reference teaches a steering means causing a "spatial offset relative to the central axis"

As noted above in the description of the present invention and as recited in appellant's independent claim 1, a "beam" is applied to the transmission means and not a uniform radiation. The steering means is a structure which causes "the radiation beam to emerge from the transmission means spatially offset relative to the central axis in free space in a known direction." While the Examiner alleges that there is a spatial offset in Tang, he is simply incorrect. As explained in the Tang Abstract, electromagnetic energy travelling through the ferrite block exits the

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radiating surface with a phase shift, but without any spatial offset, relative to the energy entering the block. There is no beam dislocation or offset or anything else associated with passage through the Tang ferrite block.

Additionally, while the Examiner may see some similarity between the ferrite yokes 42 and 44 in Figure 4 of Tang and the arms 42, 44, 46, 48 in the preferred embodiment of appellant's Figure 2, Tang fails to illuminate his ferrite block with a beam so as to provide an offset and instead illuminates with a uniform distribution with a magnetic field variation needed to provide the phase variation across the uniform radiation

The Examiner cites Figure 6 in Tang as proof that there is a beam which has been offset by Tang. However, there is no indication of any beam being input on the ferrite block of Tang, let alone that such a beam is being offset. In fact, as discussed at column 5, beginning at line 35, Tang requires an associated feed horn 89 and a collimating lens so as to provide radiation in a substantially uniform manner across the entire ferrite block (the definition of "collimating").

This non-beam uniform radiation applied to the input side of the ferrite block is then phase shifted in accordance with the amount of magnetic field applied to the block -- hence at one end of the block the radiation will be delayed substantially and the other end of the block it will not -- thereby providing for the

variation in phase of the illumination leaving the block. However, the Examiner's suggestion that a "beam" is offset is mistaken.

While the wavefront in Tang leaving the block is tilted, it still proceeds away from the ferrite block on exactly the same axis as it entered the ferrite block. Thus, to the extent there is any "beam" applied to the ferrite block, it is not steered and it is not spatially offset when it leaves the block. The fact that the beam from the end block is not offset can be clearly seen in Figure 6 by looking at center points of wavefront 90 and wavefront 92. They proceed away from the block perfectly parallel and in line with the center line of the block. Consequently, there is no disclosure in Tang of any beam, nor any beam offset being provided to such beam.

The Court of Appeals for the Federal Circuit has noted in the case of *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick*, 221 USPQ 481, 485 (Fed. Cir. 1984) that "[a]nticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim."

The Tang reference fails to teach or even suggest any steering means which causes a radiation beam to emerge "spatially offset relative to the central axis." The failure to disclose this positively recited structural relationship which is present in appellant's independent claim clearly establishes that the rejection under

35 USC §102 is unsupported by the Tang reference and any further rejection thereunder is respectfully traversed.

(b) Robertson's omnidirectional antenna teaches away from scanning and offset

Claims 13, 14, 20, 21, 25 and 27 stand rejected under 35 USC §103 as unpatentable over the combination of Tang and Robertson. The above discussion with respect to the Tang reference is herein incorporated by reference. Quite clearly, the Tang reference does not disclose a steering means which provides that the radiation beam emerges "spatially offset relative to the central axis."

Moreover, Robertson clearly teaches the undesirability of any scanning radiation beam, either mechanically or electronically, and instead suggests that it is desirable to have the radiation uniformly provided substantially over 360° in azimuth. As discussed above, this is precisely the opposite of a mechanically or electrically scanned antenna system.

Moreover, the Examiner fails to provide any motivation or reason for combining elements of the Robertson patent with the Tang patent.

Specifically, the Examiner is reminded that the Court of Appeals for the Federal Circuit has held that "the PTO has the burden under Section 103 to establish a *prima facie* case of obviousness." *In re Fine*, 5 USPQ2d 1596, 1598

(Fed. Cir. 1988). None of the references teach illumination with a beam and electronic scanning by means of an offset.

With respect to the combination of references, the Federal Circuit has also held that "teachings of references can be combined *only* if there is some suggestion or incentive to do so." *Id.* at 1599. Here the Examiner has provided no support for the allegation of it being obvious to combine these references.

The Federal Circuit has also opined that it is "error to find obviousness where references 'diverge from and teach away from the invention at hand'." *Id.* As noted above, the references all are believed to teach solutions to problems other than electronically scanning a beam around a 360° azimuth and thus teach away from the claimed invention.

(c) The Examiner has failed to provide any reason for combining elements taken from Tang and Robertson

With respect to the alleged motivation for combining these references, the Examiner has provided no support. In the recent case of *In re Rouffet* , 47 USPQ2d 1453, 1458 (Fed. Cir. 1998), the Court held that "the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner

claimed." Nowhere in either of the cited references does there appear to be any recognition of the problem solved by the claimed invention.

Finally, even if it were obvious to combine the Tang reference with the Robertson reference, and assuming the Examiner's suggestion that Tang teaches an offset beam, the use of the offset beam with the Robertson teaching of a conical reflector would merely increase the radiation on one side of the cone to the detriment of radiation from the other side of the cone. Thus, even the combination of Tang and Robertson would not provide a device for controlling the direction of a radiation beam.

As a result of the above, the Patent Office has misinterpreted the teachings in both Tang and Robertson and has failed to provide any suggestion for combining elements of these two disclosures. Accordingly, the Examiner has simply failed to set out a *prima facie* case of obviousness.

IX. CONCLUSION

As discussed above, none of the prior art references teach appellant's claimed steering means for providing a beam which emerges "spatially offset relative to the central axis." The Examiner combines two references, neither of which have anything to do with a device for controlling the direction of a radiation beam (Tang relates to distributed and uniform radiation incident on a ferrite block and Robertson teaches an omnidirectional antenna). The Examiner also fails to

provide any reason or motivation for combining elements of the two references. Even if the references were combined, the combination would not operate in the manner specified in appellant's independent claims and claims dependent thereon. Accordingly, the Examiner has failed to support the anticipation rejection, as well as establish a *prima facie* case of obviousness under 35 USC §103.

In view of the above, the rejections of claims 1-6, 13-23, 25 and 27 are clearly in error and reversal thereof by this Honorable Board is respectfully requested.

Respectfully submitted,

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SCS:kmm
Enclosures
Appendix A - Claims on Appeal

APPENDIX A

Claims on Appeal

1. A device for controlling the direction of a radiation beam, the device comprising:-

transmission means for transmitting the radiation beam from a radiation source; and

steering means for steering the radiation beam;

wherein the transmission means comprises a body of magnetic material having a central axis which forms an aperture through which the radiation beam passes, the central axis being parallel to and coincident with the direction of the radiation beam prior to incidence on the transmission means;

and wherein the steering means causes the radiation beam to emerge from the transmission means spatially offset relative to the central axis in free space in a known direction.

2. A device according to claim 1, wherein the beam is offset relative to the central axis and steered thereabout so as to define as angle θ between the central axis and the emergent direction.

3. A device according to claim 1, wherein the steering means comprises magnetic means.

4. A device according to claim 3, wherein the magnetic means applies a gradient in magnetisation across the aperture.

5. A device according to claim 4, wherein the gradient in magnetisation occupies a plane which is not perpendicular to the central axis.

6. A device according to claim 4, wherein the gradient of magnetisation rotates about the central axis.

13. A device according to claim 1, further comprising a reflective surface located adjacent a face of the body from which the beam emerges.

14. A device according to claim 13, wherein the reflective surface comprises a cone having its apex facing the face and its central axis coincident with the central axis.

15. A device according to claim 1, wherein the beam is swept through 360° in a plane which is perpendicular to the central axis.

16. A device according to claim 1, wherein the beam comprises microwave radiation.

17. A device according to claim 16, wherein the microwave radiation is millimetric radiation.

18. A device according to claim 17, wherein the radiation is at Ka band (26.5 to 40GHz).

19. A device according to claim 17, wherein the radiation is at W-band (75 to 110GHz).

20. A communications unit incorporating a device according to claim 1, and which includes radiation receiving means, modulation and demodulation means for modulating and demodulating information onto and from the radiation beam.

21. A communications system comprising a plurality of communications units according to claim 20.

22. A device, as in claim 1, characterised in that the beam of radiation is at Ka band (26.5 to 40GHz).

23. A device, as in claim 1, characterised in that the beam of radiation is at W-band (75 to 110GHz).

25. A communications unit incorporating a device as in claim 1 including, radiation receiving means and modulation and demodulation means for modulating and demodulating information onto and from radiation.

27. A communications system comprising a plurality of units as in claim 25.